OAS Presidential Address, April 2004

Pirouetting Pigs and the Charade of Junk Science

We scientists often take pride and great comfort in realizing that we live in The Age of Science. Perhaps our pride has turned to hubris and our comfort to complacency regarding our role in this age. The general public, even our friends, neighbors, and relatives who aren't scientists recognize we live in The Age of Science. Science surrounds our daily lives. Science is involved in many of the major stories of the day, covered on front pages of newspapers and as leading stories on the evening news. From Martian rovers to global climate change to biomedical advances that lead to longer, healthier lives, science has an evident role in many of our most exciting and interesting moments these days. The tangible benefits of science to our daily experiences are seen frequently: from hybrid fuel-efficient cars and pocket PCs, to organ transplants, weight-control medications, *in vitro* fertilization, and a myriad of other medical achievements. Thought of as science fiction not too many years ago, these are today's science facts.

Is it any wonder that scientists are called upon to solve many of the most pressing issues of the day? Science has become such a pervasive part of our lives that scientists are now viewed as the necessary "royal viziers" to nations and national leaders. So much so that it is necessary now for those who govern not only to have the advice of scientists but to show that their actions are based on science. President Bush, The Elder, stated it well when he said in 1990:

> "Science, like any field of endeavor, relies on freedom of inquiry; and one of the hallmarks of that freedom is objectivity. Now more than ever, on issues ranging from climate change to AIDS research to genetic engineering to food additives, government relies on the impartial perspective of science for guidance."

Many of us, myself included, work to provide the knowledge necessary for sound decisions for ecosystem management and wise use of environmental resources. Others provide information necessary for policy decisions ranging from how best to wage war to how best to find peaceful solutions to wars. Nations have become great, at least in part, because of the accomplishments of their scientists and the access of their leaders to those scientists (Union of Concerned Scientists, 2004).

"Science" has become the necessary "Good Housekeeping Seal of Approval" for policies and pronouncements of governments and industries and institutions. It has become necessary for major decisions to have the backing of "scientific investigation" . . . or at least to have the *appearance* of the backing by scientific investigation. Today, with the increasing value of the imprimatur of science, we see scientific-sounding pronouncements that are based on a charade of the scientific process and whole institutions that masquerade as purveyors of scientific notions.

Let me give two examples with the assurance that you can easily find many other examples for yourself, as they seem to appear with increasing frequency and greater transparency these days. Example 1 is the Center for Science and Culture. The CSC is supported by and is a direct activity of the Discovery Institute, which describes the CSC as "the nation's leading think tank and research center examining scientific challenges to Darwinian evolution. Discovery Institute is a non-profit, non-partisan, public-policy, think tank, which promotes ideas in the common sense tradition of representative government, the free market and individual liberty." Further, "the point of view Discovery brings to its work includes a belief in God-given reason and the permanency of human nature . . ." (Discovery Institute web page, 2004). I see nothing wrong with "promoting ideas in the common sense tradition of representative government," whatever that may mean, and I respect their right to "belief in God-given reason and the permanency of human nature." But clearly their activities are focused on promoting a particular agenda rather than being devoted to a dispassionate investigation of natural phenomena, letting the chips fall on the data points, wherever they may be and whatever implications they may have. Equally clearly, their agenda is to appear to be "scientific." In point of fact, the CSC promotes the teaching of religious doctrines alongside legitimate, peer-reviewed research that details evolution of human ancestry. Whatever it is that the CSC does, it isn't science, but it is dressed up in semi-technical verbiage to sound like science with the intent of influencing social and political decision making processes.

Example 2 is even more insidious, I believe, because it affects the public health in the guise of scientific soundness. In the days following the World Trade Center catastrophe, the EPA was called upon to assess the safety of the air for human habitation. This was an entirely legitimate action, one of the good uses of science, to set an important problem to measurement and inquiry, and to provide a trustworthy result based on good science that in turn could lead to reliable decision making for the citizens of New York City. On 13 September the USEPA announced that asbestos dust in the area was "very low" or "entirely absent" when the fact of the matter was that over 25% of the air samples taken in the Manhattan area showed asbestos levels in excess of the 1% safety benchmark. The purpose of the erroneous pronouncement I can only speculate upon, but the result of it was that people in the area accepted the result as trustworthy because it was "scientific"—so they walked around unprotected. The result was that a study conducted by Mt. Sinai School of Medicine reported that 88% of the rescue workers suffered lung ailments in the months following the attack and half had persistent respiratory ailments one year after the attack. Dan Tishman, whose company was involved in reconstruction of

the area, stated (Kennedy, 2004):

> "The frustrating thing is that everyone just counts on the EPA to be the watchdog of public health. When that role is compromised, people can get hurt."

Rather than continue to chew on selected bones of contention, I shall get to the marrow of the matter. We scientists need to be careful that the public understands the nature of science, its processes, its capabilities, and its limitations. The public-at-large must be able to distinguish between science and a parody of science. We must train not only our students in the conduct of science, we must teach society-at-large the nature of science—and how best to identify what masquerades for science being phrased in scientific-sounding lingo and dressed in a garb of polysyllabic words. We need to lead in this; we cannot leave it to lexicographers to define "science" in our absence.

It is time that we make it plainly clear that all of the achievements and pronouncements viewed as science aren't science, they are the *result* of science. Science is not the destination, it is the vehicle. Science is a process conducted by people highly trained and skilled in its conduct. Much like classical ballet is a skill that requires long years of training to provide even a passably acceptable result in public performance. Yet much of what has been paraded in front of the public as "science" is the balletic equivalent of pigs pirouetting in pink tutus. Pirouetting pigs may make for a nice trained animal act but that doesn't mean that it should be considered on a par with the Bolshoi Ballet. Especially, it does not mean that a trained pig act needs to be included in a textbook on classical ballet in the name of "fairness" and making sure that "all sides of the issue are presented." The public needs to be able to identify junk science as easily as it can identify pirouetting pigs auditioning for prima ballerinas.

What then is science?

> "Science is a systematic method of continuing investigation, based on observation, hypothesis testing, experimentation, and theory building, which leads to more adequate explanations of natural phenomena, explanations that are open to further testing, revision, and falsification, and while not "believed in" through faith may be accepted or rejected on the basis of evidence."
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> — The Ohio Academy of Science (2004)

We in The Ohio Academy of Science need to keep doing what we have been doing—promoting good science in a public venue under a peer-review process. I have been proud to stand at the helm of this organization for the past year because we have taken strong public stands regarding the societal need for honest, accurate science education. Good science is a skill that is learned through experience and guidance by mentors over many years. It is a practiced skill. It cannot be learned well from only reading about it. That is why we spend so much time working with our students, and that is why the OAS sponsors District and State Science Days. There is no substitute for the experiential, hands-on approach in teaching or learning science.

We know what science is from our training and professional experiences; the public-at-large needs to know what science is, too. The general public, our non-scientific neighbors, friends, and relatives need to become aware of the difference between true scientific enquiry and the display of opinion and demagoguery dressed in a lab coat. We need to be more willing to express our disgust and even our outrage at charades of science that seem well intentioned on the surface but are insidious in their effect and harmful in their result. The long-term success of our nation, indeed the life and health of the world and its biosphere may well depend on our success in this matter.

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